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In re Application of:

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Sir:

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VERIFICATION OF A TRANSLATION

I, the below named translator, hereby declare that:

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That I am knowledgeable in the English language and in the Japanese language
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certified copies of Japanese Patent Application Nos. Hei. 11-281740 and Hei. 11-281741
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I hereby declare that all statements made herein of my own knowledge are true
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[Name of Document] Specification
[Title of Invention] 5-Direction key operating device
[Claims for Patent]

[Claim 1] A 5-direction key operating device in which diaphragms respectively corresponding to five directions are proximately arranged in a shape of a cross, which comprises pushers corresponding to the five directions on a key core face opposed to the diaphragms, and in which a single key is enabled to perform key operations of the five directions, and characterized in that

each of diaphragm contacts which are disposed on a printed circuit board opposed to the diaphragms is structured to have a first contact, and one or more second contacts surrounding the first contact, the second contact including one or more strip-like contact portions which extends in a fan shape with respect to the center of the first contact on a side opposite to a first contact, and

the diaphragm contacts are arranged on the printed circuit board in a shape of a cross correspondingly with the five directions with tilting the strip-like contact portions of the diaphragm contacts by about 45 degrees to vertical and horizontal directions.

[Claim 2] A 5-direction key operating device in which diaphragms respectively corresponding to five directions are proximately arranged in a shape of a cross,

which comprises pushers corresponding to the five directions on a key core face opposed to the diaphragms, and in which a single key is enabled to perform key operations of the five directions, and characterized in that

each of diaphragm contacts which are disposed on a printed circuit board opposed to the diaphragms is structured to have a first contact, and one or more second contacts surrounding the first contact, one or more strip-like contact portions which are elongated from each of the second contacts to a side opposite to a side of the first contact are disposed in the second contact, and

the diaphragm contacts are arranged on the printed circuit board in a shape of a cross correspondingly with the five directions with tilting the strip-like contact portions of the diaphragm contacts by about 45 degrees to vertical and horizontal directions.

[Detailed Description of Invention]

[0001]

[Technical Field to Which the Invention Pertains]

The present invention relates to a 5-direction key operating device for a portable telephone or the like, and particularly to a configuration in which the structure of diaphragm contacts disposed on a printed circuit board is improved to allow diaphragms to be disposed in a minimum space, and the same button key is enabled to perform key

operations of five directions (upper, lower, right, and left + center).

[0002]

[Conventional Art]

Conventionally, a 5-direction key operating device such as shown in Fig. 6 is known. In the main unit 100 of a portable telephone, a display section 101 such as a liquid crystal display device, and an operation section 102 in which various keys are arranged are disposed. The operation section 102 is configured by: a first portion consisting of cursor-movement keys 103 and an enter key 104; and a second portion consisting of ten keys, menu keys, and other keys 105. Among them, the first portion constitutes a 5-direction key operating device.

[0003]

The five directions mean the upward, downward, rightward, and leftward directions (see triangular arrows in the figure), and the central direction. Usually, a cursor is moved among instruction displays on the display section 101 by operating keys of the forward, rearward, rightward, and leftward directions, i.e., the cursor-movement keys 103, and the instruction display to which the cursor is moved is determined by operating the central direction key, i.e., the enter key 104.

[0004]

[Problems to be solved by the Invention]

In the conventional 5-direction key operating device described above, the four cursor-movement keys 103 and the one enter key 104 are independently disposed, and hence there are problems in that a substantially large space is required for placing these keys, and that, when the keys are to be actually operated, the movement range of a specific finger is widened and the time period for the operation is correspondingly prolonged.

[0005]

Therefore, it is an object of the invention to provide a 5-direction key operating device in which the structure of diaphragm contacts disposed on a printed circuit board is improved to allow five diaphragms to be disposed in a minimum space, and the five diaphragms can be operated by one button key.

[0006]

[Means for solving the Problems]

The invention described in Claim 1 of the present invention is a 5-direction key operating device in which diaphragms respectively corresponding to five directions are proximately arranged in a shape of a cross, which comprises pushers corresponding to the five directions on a key core face opposed to the diaphragms, and in which a single key is enabled to perform key operations of the five directions, and characterized in that each of diaphragm contacts which are disposed on a printed circuit board

opposed to the diaphragms is structured to have a first contact, and one or more second contacts surrounding the first contact, the second contact including one or more strip-like contact portions which extends in a fan shape with respect to the center of the first contact on a side opposite to a first contact, and the diaphragm contacts are arranged on the printed circuit board in a shape of a cross correspondingly with the five directions with tilting the strip-like contact portions of the diaphragm contacts by about 45 degrees to vertical and horizontal directions.

[0007]

The invention described in Claim 2 of the present invention is a 5-direction key operating device in which diaphragms respectively corresponding to five directions are proximately arranged in a shape of a cross, which comprises pushers corresponding to the five directions on a key core face opposed to the diaphragms, and in which a single key is enabled to perform key operations of the five directions, and characterized in that each of diaphragm contacts which are disposed on a printed circuit board opposed to the diaphragms is structured to have a first contact, and one or more second contacts surrounding the first contact, one or more strip-like contact portions which are elongated from each of the second contacts to a side opposite to a side of the first contact are disposed in the second contact, and the diaphragm contacts are

arranged on the printed circuit board in a shape of a cross correspondingly with the five directions with tilting the strip-like contact portions of the diaphragm contacts by about 45 degrees to vertical and horizontal directions.

[0008]

[Mode for Carrying Out the Invention]

Hereinafter, an embodiment of the invention will be described with reference to Figs. 1 to 5.

[0009]

Fig. 1 is an exploded perspective view of a 5-direction key operating device which is an embodiment of the invention, and which is incorporated into a portable telephone or the like. Fig. 2 is a section view taken along the line A-A of Fig. 1, after assembled as a portable telephone.

[0010]

Referring to Fig. 1, in a portable telephone or the like, usually, ten keys 31 and the like are formed integrally with a key sheet 30 made of silicon rubber or the like, and the assembly is attached to a predetermined position of a cover 10, and placed so as to be opposed to diaphragms 4 disposed on a printed circuit board 40.

[0011]

The 5-direction key operating device of the invention is configured by a 5-direction key 6 which is the largest key standing on the key sheet 30, and the

diaphragms 4 which correspond thereto, and which are arranged in the shape of a cross.

[0012]

Fig. 2 is a section view taken along the line A-A of Fig. 1 and showing the configuration of the 5-direction key operating device of the embodiment of the invention, after assembled as a portable telephone. In Fig. 2, three diaphragms 4 are shown on the printed circuit board 40, and three pushers 34 are disposed on the core face of the 5-direction key 6 opposed to the diaphragms and on a key base 32. The shape of the center pusher (although the section shape is triangular, the center pusher actually has a quadrangular pyramidal shape) is set to be different from that of the right and left pushers (although the section shape is trapezoidal, the pushers actually have a cylindrical shape).

[0013]

In a design by those skilled in the art, as contacts on which the diaphragms 4 that are arranged in the shape of a cross in accordance with the 5-direction key 6 are to be placed, it is usual to design so that doughnut-shaped contacts such as shown in Fig. 3, i.e., first contacts 1 and second contacts 2 are disposed on the printed circuit board 40 and predetermined diaphragms 4 are placed thereon.

[0014]

In this design, with respect to the space for disposing the diaphragm contacts, however, there is no choice other than that the minimum space is formed by placing the second contacts 2 to be placed as close as possible to the limit where the contacts are not in contact with each other.

[0015]

Unlike the conventional design as discussed above, in the invention, the space for disposing diaphragm contacts is further reduced, and second contacts is devised, whereby the whole device can be miniaturized and lightened.

[0016]

Fig. 4 shows the configuration of the diaphragm contacts in the first embodiment of the invention. Referring to Fig. 4, each of the diaphragm contacts has a circular contact 1 which is a first contact, and strip-like contact portions 3a to 3d which are elongated in a fan-like shape with respect to the center of the first contact 1 are disposed in a second contact 2 and in the side opposite to the side of the first contact 1.

[0017]

Since a fan-like shape is employed, the area of a metal pattern portion of the second contact 2 is larger as the portion is further separated from the center of the first contact 1. Even when the shape of the outer periphery of the diaphragm 4 is somewhat waved by uneven

quality of production, therefore, the outer periphery of the diaphragm 4 is in contact with any one of the many strips, so that conduction can be ensured.

[0018]

Five diaphragm contacts which are configured as described above are arranged in the shape of a cross so that the strip-like contact portions 3a and 3c, and the strip-like contact portions 3b and 3d are tilted by about 45 degrees to the vertical and horizontal directions. According to this configuration, places where there is a fear that the second contacts 2 (actually, the strip-like contact portions 3) are in contact with each other form about 45 degrees. Therefore, the diaphragms 4 can be arranged in close proximity to each other, and the space for disposing the diaphragms can be minimized.

[0019]

Fig. 5 shows the configuration of the diaphragm contacts in the second embodiment of the invention. Referring to Fig. 5, each of the diaphragm contacts has a circular contact 1 which is a first contact, and strip-like contact portions 3a' to 3d' which are rectangular, and which are elongated from the second contact 2 are disposed in the second contact 2 and in the side opposite to the side of the first contact 1.

[0020]

Five diaphragm contacts which are configured as

described above are arranged in the shape of a cross so that the strip-like contact portions 3a' and 3c', and the strip-like contact portions 3b' and 3d' are tilted by about 45 degrees to the vertical and horizontal directions in the same manner as described above. According to this configuration, places where there is a fear that the second contacts (actually, the strip-like contact portions 3) 2 are in contact with each other form about 45 degrees. Therefore, the diaphragms 4 can be arranged in close proximity to each other, and the space for disposing the diaphragms can be minimized.

[0021]

In the above description, the second contacts each of which is formed into a single-doughnut like shape have been illustrated. Alternatively, the device may be configured by disposing a plurality of doughnut-like shapes in each of the diaphragms.

[0022]

[Effects of the Invention]

As described above, the invention provides a 5-direction key operating device in which diaphragms respectively corresponding to five directions are proximately arranged in a shape of a cross, which includes pushers corresponding to the five directions on a key core face opposed to the diaphragms, and in which a single key is enabled to perform key operations of the five directions,

and characterized in that each of diaphragm contacts which are disposed on a printed circuit board opposed to the diaphragms are structured to have a first contact, and one or more second contacts surrounding the first contact, one or more strip-like contact portions which are elongated from each of the second contacts to a side opposite to a side of the first contact are disposed in the second contact, and the diaphragm contacts are arranged on the printed circuit board in a shape of a cross correspondingly with the five directions with tilting the strip-like contact portions of the diaphragm contacts by about 45 degrees to vertical and horizontal directions. The invention attains advantages that the diaphragms can be disposed in a minimum space, and that the same button key is enabled to perform key operations of five directions (upper, lower, right, and left + center).

[Brief Description of Drawings]

[Fig. 1]

Fig. 1 is a view showing the configuration of a 5-direction key operating device of an embodiment of the invention.

[Fig. 2]

Fig. 2 is a section view taken along the line A-A of Fig. 1 and showing the configuration of the assembled 5-direction key operating device of the embodiment of the invention.

[Fig. 3] .

Fig. 3 is a view showing the structure of diaphragm contacts, the diaphragm contacts being arranged in a shape of a cross.

[Fig. 4]

Fig. 4 is a view showing the structure of diaphragm contacts in the first embodiment of the invention, the diaphragm contacts being arranged in a shape of a cross.

[Fig. 5]

Fig. 4 is a view showing the structure of diaphragm contacts in a second embodiment of the invention.

[Fig. 6]

Fig. 6 is a view showing the configuration of a conventional 5-direction key operating device.

[Description of Reference Numerals]

| | |
|----|----------------------------------|
| 1 | first contact |
| 2 | second contact |
| 3 | strip-like contact portion |
| 4 | diaphragm |
| 6 | 5-direction key |
| 10 | cover |
| 20 | 5-direction key operating device |
| 30 | key sheet |
| 31 | ten keys |
| 32 | key base |
| 34 | pusher |

40 printed circuit board
100 main unit of a portable telephone
101 display section
102 operation section
103 cursor-movement key
104 enter key
105 ten keys and other keys

[Name of Document] Abstract

[Abstract]

[Object] The object is to provide a 5-direction key operating device which allows five diaphragms to be disposed in a minimum space, and the same button key is enabled to perform key operations of five directions by devising a structure of contacts of the diaphragms on a printed circuit board.

[Means for Solution] In each of diaphragm contacts on which diaphragms 4 that are arranged in the shape of a cross in correspondence with 5-direction keys are to be placed, a circular contact 1 which is a first contact, and strip-like contact portions 3a to 3d which are elongated in a fan-like shape with respect to the center of the first contact 1 are disposed in a second contact 2 and in the side opposite to the side of the first contact 1. According to this configuration and arrangement, the space for disposing the diaphragm contacts can be reduced, and the whole device can be miniaturized and lightened.

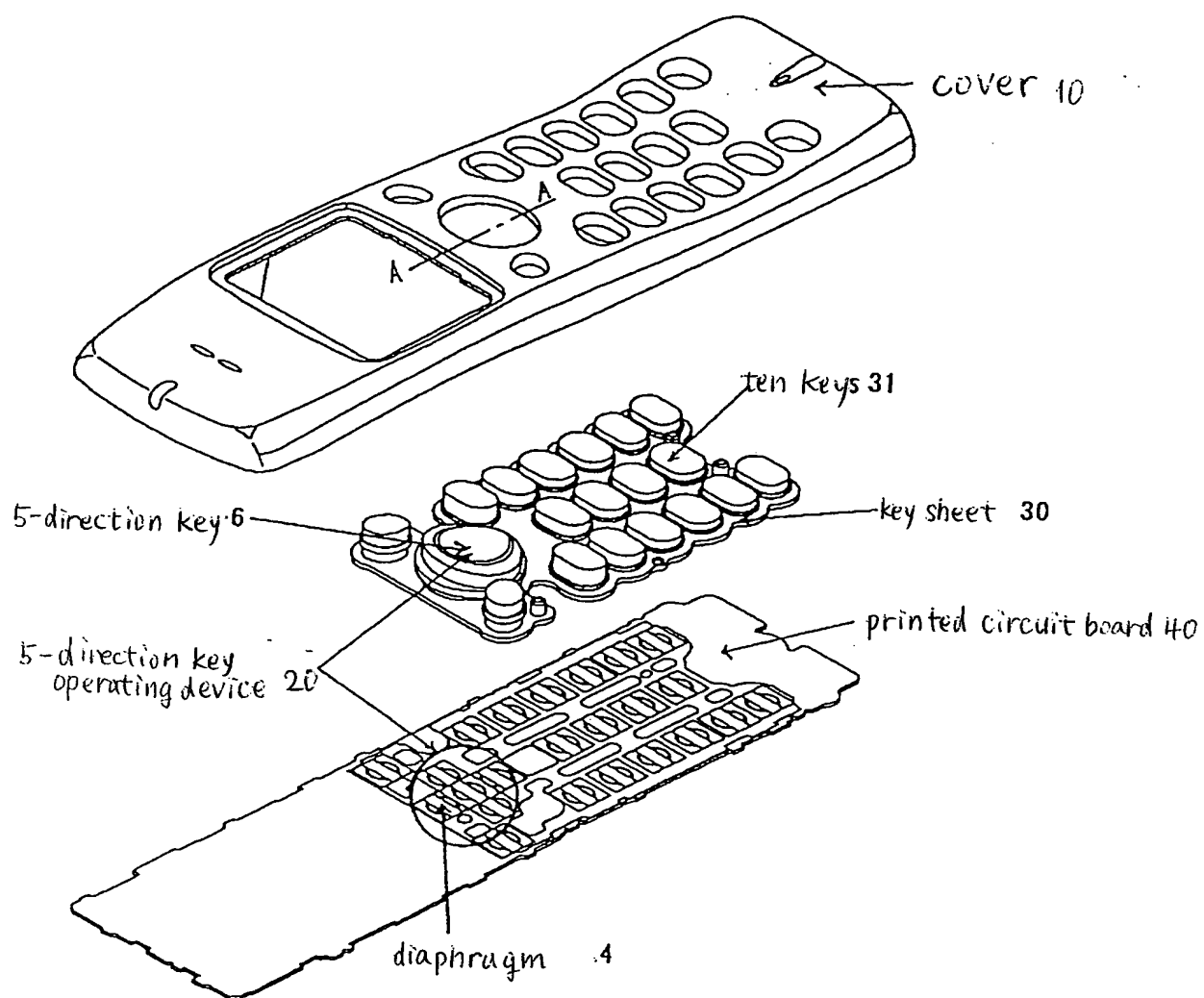
[Selected Figure] Fig. 4

Reference No.=290 481 9592

Hei. 11-281740

DRAWINGS

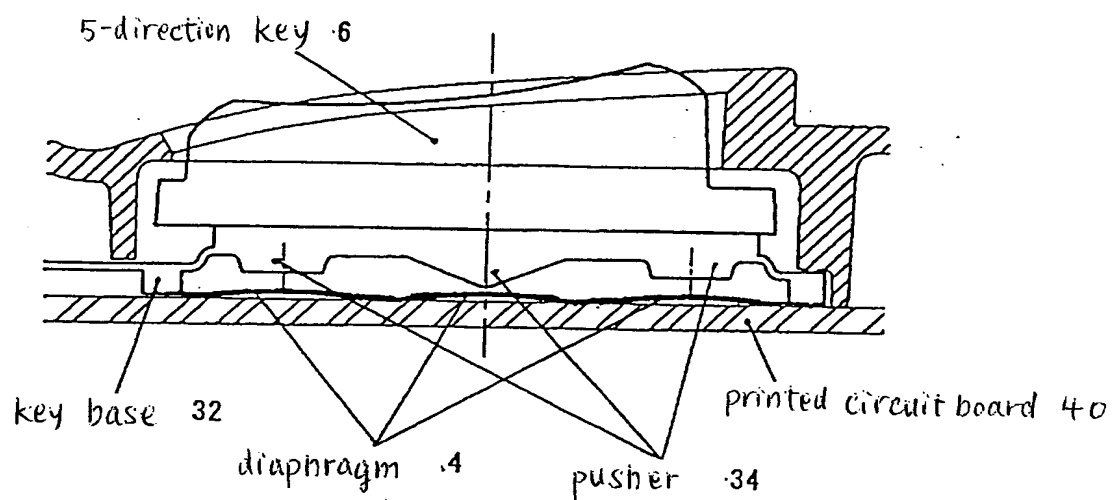
[Fig. 1]



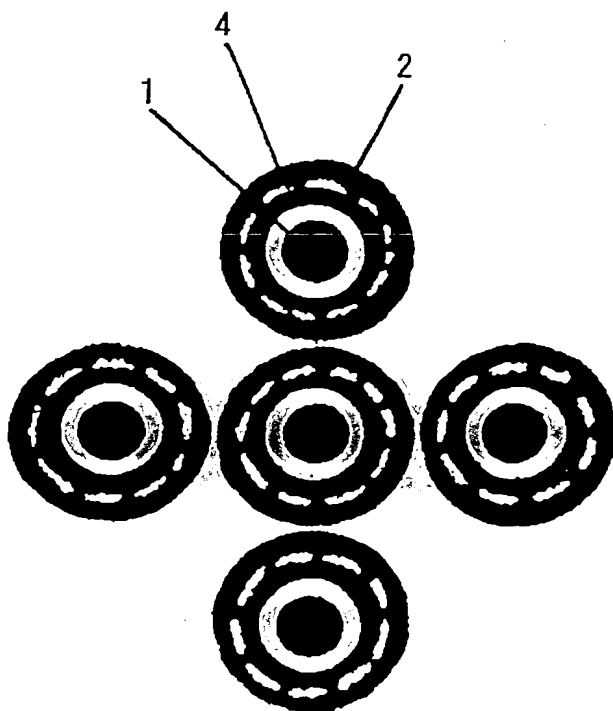
Reference No= 290481 9592

Hei. 11-281740

[Fig.2]



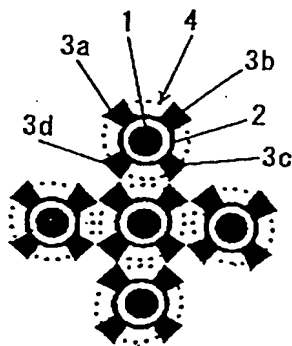
[Fig.3]



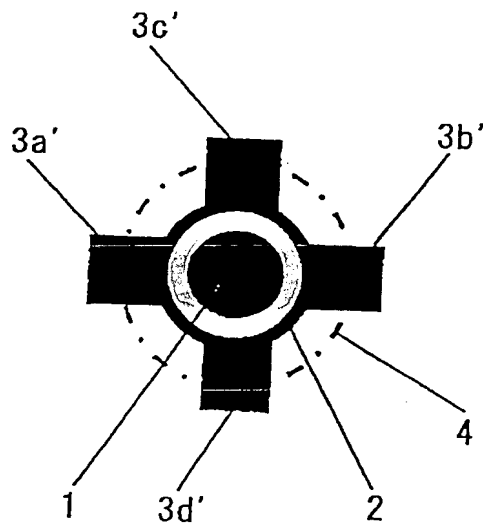
Reference No. = 2904819592

Hei. 11-281740

[Fig. 4]



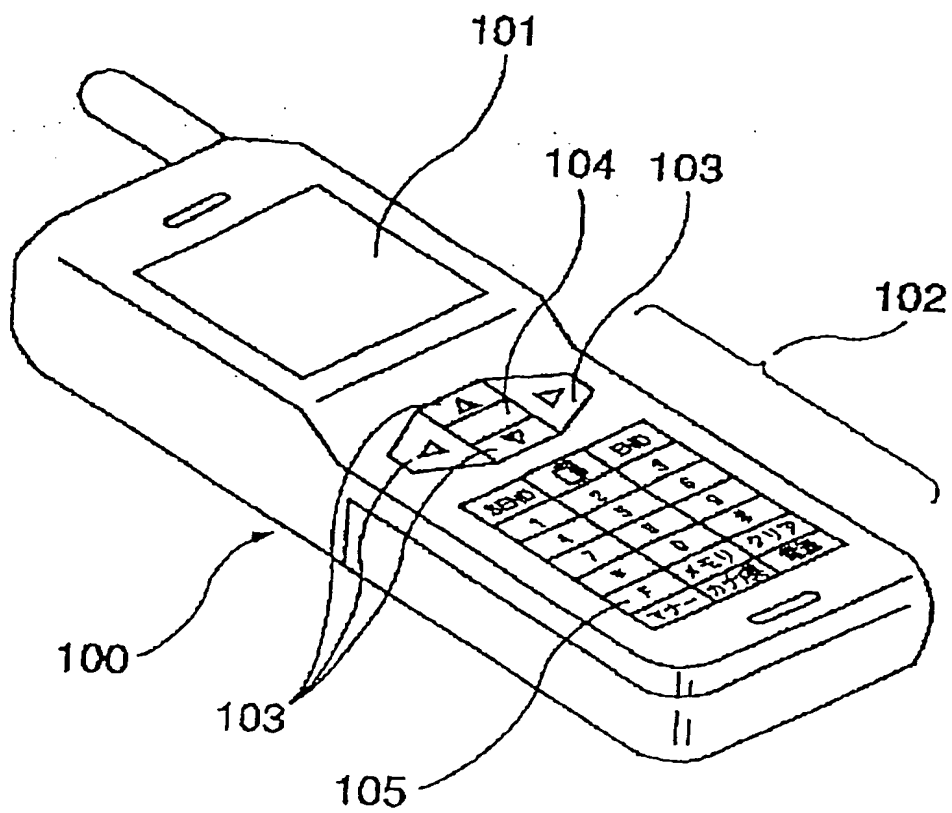
[Fig. 5]



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[Fig. 6]



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[Name of Document] Specification
[Title of Invention] 5-Direction key operating device
[Claims for Patent]

[Claim 1] A 5-direction key operating device, characterized in that five diaphragms are proximately arranged in a shape of a cross, pusher portions are disposed on a key core face opposed to the diaphragms, and a structure of a center pusher portion is different from a structure of pusher portions surrounding the center pusher portion, whereby a single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[Claim 2] The 5-direction key operating device according to Claim 1, characterized in that a height of the center pusher portion from the diaphragm is different from a height of the surrounding pusher portions from the respective diaphragms, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[Claim 3] The 5-direction key operating device according to Claim 1, characterized in that a shape of the center pusher portion is different from a shape of the surrounding pusher portions, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[Claim 4] The 5-direction key operating

device according to Claim 1, characterized in that a cross-sectional diameter of the center pusher portion is different from a cross-sectional diameter of the surrounding pusher portions, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[Claim 5] The 5-direction key operating device according to Claim 1, characterized in that a rib or a boss stands from an arbitrary position of the key core face on which the pusher portions exist, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[Claim 6] A 5-direction key operating device, characterized in that five diaphragms are proximately arranged in a shape of a cross, and a structure of a key skirt portion which is formed in a periphery of the key core face opposed to the diaphragms is changed, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[Claim 7] The 5-direction key operating device according to Claim 6, characterized in that a width or thickness of the key skirt portion is changed, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[Claim 8] The 5-direction key operating device according to Claim 6, characterized in that a shape

of the key skirt portion is changed, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[Claim 9] A 5-direction key operating device, characterized in that diaphragms respectively corresponding to operations of five directions are proximately arranged in a shape of a cross, and a load on a center diaphragm is changed from loads on surrounding diaphragms, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[Claim 10] A 5-direction key operating device, characterized in that the five diaphragms are proximately arranged in a shape of a cross, and a load on a center diaphragm is changed from loads on surrounding diaphragms, and pusher portions are disposed on a key core face opposed to the diaphragms, and a structure of a center pusher portion is different from a structure of pusher portions surrounding the center pusher portion, whereby a single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[Claim 11] The 5-direction key operating device according to Claim 10, characterized in that a rib or a boss stands from an arbitrary position of the key core face on which the pusher portions exist.

[Claim 12] A 5-direction key operating device, characterized in that five diaphragms are proximately

arranged in a shape of a cross, a load on a center diaphragm is changed from loads on surrounding diaphragms, and a structure of a key skirt portion which is formed in a periphery of the key core face opposed to the diaphragms is changed, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[Claim 13] A 5-direction key operating device, characterized in that five diaphragms are proximately arranged in a shape of a cross, a load on a center diaphragm is changed from loads on surrounding diaphragms, and pusher portions are disposed on a key core face opposed to the diaphragms, a structure of a center pusher portion is different from a structure of pusher portions surrounding the center pusher portion, and a structure of a key skirt portion which is formed in a periphery of the key core face opposed to the diaphragms is changed, whereby a single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[Detailed Description of Invention]

[0001]

[Technical Field to Which the Invention Pertains]

The present invention relates to a 5-direction key operating device for a portable telephone or the like which includes a PHS (Personal Handyphone System), and particularly to a configuration in which a rubber base of a

key core face is improved so that the same operation button is enabled to smoothly perform key operations of five directions (upper, lower, right, and left + center) without causing an erroneous operation.

[0002]

[Conventional Art]

Conventionally, a 5-direction key operating device such as shown in Fig. 13 is known. In the main unit 100 of a portable telephone, a display section 101 such as a liquid crystal display device (LCD), and an operation section 102 in which various keys are arranged are disposed.

The operation section 102 is configured by: a first portion consisting of cursor-movement keys 103 and an enter key 104; and a second portion consisting of ten keys, menu keys, and other keys 105. Among them, the first portion constitutes a 5-direction key operating device.

[0003]

The five directions mean the upward, downward, rightward, and leftward directions (see triangular arrows in the figure), and the central direction. Usually, a cursor is moved among instruction displays on the display section 501 by operating keys of the forward, rearward, rightward, and leftward directions, i.e., the 503, and the instruction display to which the cursor is moved is determined by operating the central direction key, i.e., the enter key 504.

[0004]

[Problems to be solved by the Invention]

In the conventional 5-direction key operating device described above, the four cursor-movement keys 103 and the one enter key 104 are independently disposed, and hence there are problems in that a substantially large space is required for placing these keys, and that, when the keys are to be actually operated, the movement range of a specific finger is widened and the time period for the operation is correspondingly prolonged.

[0005]

In view of the above, a object of the present invention is to provide a 5-direction key operating device in which an operation space can be reduced, and desired one of information displayed on a display section can be selected and determined by a smooth key operation without causing an erroneous operation.

[0006]

[Means for solving the Problem]

The invention described in Claim 1 of the present invention is a 5-direction key operating device characterized in that five diaphragms are proximately arranged in a shape of a cross, pusher portions are disposed on a key core face opposed to the diaphragms, and a structure of a center pusher portion is different from a structure of pusher portions surrounding the center pusher

portion, whereby a single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[0007]

The invention described in Claim 2 is characterized in that, in the 5-direction key operating device described in Claim 1, a height of the center pusher portion from the diaphragm is different from a height of the surrounding pusher portions from the respective diaphragms, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[0008]

The invention described in Claim 3 is characterized in that, in the 5-direction key operating device described in Claim 1, a shape of the center pusher portion is different from a shape of the surrounding pusher portions, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[0009]

The invention described in Claim 4 is characterized in that, in the 5-direction key operating device described in Claim 1, a cross-sectional diameter of the center pusher portion is different from a cross-sectional diameter of the surrounding pusher portions, whereby the single key is enabled to smoothly perform operations of five directions

without causing an erroneous operation.

[0010]

The invention described in Claim 5 is characterized in that, in the 5-direction key operating device described in Claim 1, a rib or a boss stands from an arbitrary position of the key core face on which the pusher portions exist, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[0011]

The invention described in Claim 6 is a 5-direction key operating device characterized in that the five diaphragms are proximately arranged in a shape of a cross, and a structure of a key skirt portion which is formed in a periphery of the key core face opposed to the diaphragms is changed, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[0012]

The invention described in Claim 7 is characterized in that, in the 5-direction key operating device described in Claim 6, a width or thickness of the key skirt portion is changed, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[0013]

The invention described in Claim 8 is characterized in that, in the 5-direction key operating device described in Claim 6, a shape of the key skirt portion is changed, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[0014]

The invention described in Claim 9 is a 5-direction key operating device characterized in that diaphragms respectively corresponding to operations of five directions are proximately arranged in a shape of a cross, and a load on a center diaphragm is changed from loads on surrounding diaphragms, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[0015]

The invention described in Claim 10 is a 5-direction key operating device characterized in that the five diaphragms are proximately arranged in a shape of a cross, and a load on a center diaphragm is changed from loads on surrounding diaphragms, and pusher portions are disposed on a key core face opposed to the diaphragms, and a structure of a center pusher portion is different from a structure of pusher portions surrounding the center pusher portion, whereby a single key is enabled to smoothly perform operations of five directions without causing an

erroneous operation.

[0016]

The invention described in Claim 11 is characterized in that, in the 5-direction key operating device described in Claim 10, a rib or a boss stands from an arbitrary position of the key core face on which the pusher portions exist.

[0017]

The invention described in Claim 12 is a 5-direction key operating device characterized in that the five diaphragms are proximately arranged in a shape of a cross, a load on a center diaphragm is changed from loads on surrounding diaphragms, and a structure of a key skirt portion which is formed in a periphery of the key core face opposed to the diaphragms is changed, whereby the single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[0018]

The invention described in Claim 13 is a 5-direction key operating device characterized in that the five diaphragms are proximately arranged in a shape of a cross, a load on a center diaphragm is changed from loads on surrounding diaphragms, and pusher portions are disposed on a key core face opposed to the diaphragms, a structure of a center pusher portion is different from a structure of pusher portions surrounding the center pusher portion, and

a structure of a key skirt portion which is formed in a periphery of the key core face opposed to the diaphragms is changed, whereby a single key is enabled to smoothly perform operations of five directions without causing an erroneous operation.

[0019]

[Mode for Carrying Out the Invention]

Next, embodiments of the invention will be described with reference to Figs. 1 to 12.

[0020]

Fig. 1 is an exploded perspective view of a 5-direction key operating device which is an embodiment of the invention, and which is incorporated into a portable telephone including a PHS (Personal Handyphone system) or the like. Figs. 2 to 11 are section views taken along the line A-A of Fig. 1, after assembled as a portable telephone.

[0021]

Referring to Fig. 1, in a portable telephone including a PHS or the like, usually, ten keys 22 and the like are formed integrally with a key sheet 21 made of silicon rubber or the like, and the assembly is attached to a predetermined position of a cover 10, and placed so as to be opposed to diaphragms 23 disposed on a printed circuit board 24.

[0022]

The 5-direction key operating device of the

invention is configured by a largest key which is standing on the key sheet 21, and the diaphragms 23 which correspond thereto, and which are arranged in the shape of a cross.

[0023]

Fig. 2(a) is a section view taken along the line A-A of Fig. 1 and showing the configuration of the assembled 5-direction key operating device of a first embodiment of the invention. In Fig. 2(a), five diaphragms 23 are shown on the printed circuit board 24, and five pusher portions 26 are disposed on the core face opposed to the diaphragms and on a key base 27. As shown in Fig. 2(b) which is a view of the key sheet 21 as viewed from the below, four pusher portions 26b are placed in upper, lower, right, and left sides with being centered at the center pusher portion 26. The height of the center pusher portion is set to be larger than that of the upper, lower, right, and left pusher portions.

[0024]

In the thus configured 5-direction key operating device, although a single key top 25 is disposed, the height of the center pusher portion is different from that of the surrounding pusher portions. Therefore, the pushing sensation experienced when the center pusher portion is pressed is different from that experienced when one of the upper, lower, right, and left pusher portions is pressed. Consequently, the key operation can be smoothly performed

without causing an erroneous operation.

[0025]

Fig. 4 is a section view taken along the line A-A of Fig. 1 and showing another other configuration of the assembled 5-direction key operating device of the first embodiment of the invention. The concept is similar to that of Fig. 2(a), but, unlike Fig. 2(a), the height of the upper, lower, right, and left pusher portions is set to be larger than that of the center pusher portion.

[0026]

In the thus configured 5-direction key operating device, although a single key top 25 is disposed, the height of the center pusher portion is different from that of the surrounding pusher portions. Therefore, the pushing sensation experienced when the center pusher portion is pressed is different from that experienced when one of the upper, lower, right, and left pusher portions is pressed. Consequently, the key operation can be smoothly performed without causing an erroneous operation.

[0027]

Fig. 4 is a section view taken along the line A-A of Fig. 1 and showing the configuration of an assembled 5-direction key operating device of a second embodiment of the invention. The shape (which is identical with that of Figs. 2(a) and 3, or trapezoidal) of the upper, lower, right, and left pusher portions is set to be different from

that (unlike Figs. 2(a) and 3, arcuate) of the center pusher portion.

[0028]

In the thus configured 5-direction key operating device, although a single key top 25 is disposed, the shape of the center pusher portion is different from that of the surrounding pusher portions. Therefore, the pushing sensation experienced when the center pusher portion is pressed is different from that experienced when one of the upper, lower, right, and left pusher portions is pressed. Consequently, the key operation can be smoothly performed without causing an erroneous operation.

[0029]

Fig. 5 is a section view taken along the line A-A of Fig. 1 and showing another configuration of the assembled 5-direction key operating device of the second embodiment of the invention. Unlike that of Fig. 4, the shape of the center pusher portion is changed from an arcuate one to a triangular one. The other components are set to be identical with those of Fig. 4.

[0030]

This configuration can attain the same effect as that of Fig. 4, although the pushing sensation is different from that of Fig. 4 because the shape of the center pusher portion is different from that of the center pusher portion of Fig. 4.

[0031] .

Fig. 6 is a section view taken along the line A-A of Fig. 1 and showing the configuration of an assembled 5-direction key operating device of a third embodiment of the invention. The cross-sectional diameter of the center pusher portion which is trapezoidal in the same manner as Figs. 2(a) and 3 is set to be larger than that of the upper, lower, right, and left pusher portions which are trapezoidal in the same manner as Figs. 2(a) and 3.

[0032]

In the thus configured 5-direction key operating device, although a single key top 25 is disposed, the cross-sectional diameter of the center pusher portion is different from that of the surrounding pusher portions. Therefore, the pushing sensation experienced when the center pusher portion is pressed is different from that experienced when one of the upper, lower, right, and left pusher portions is pressed. Consequently, the key operation can be smoothly performed without causing an erroneous operation.

[0033]

Fig. 7 is a section view taken along the line A-A of Fig. 1 and showing another configuration of the assembled 5-direction key operating device of the third embodiment of the invention. Unlike that of Fig. 6, the cross-sectional diameter of the center pusher portion is

smaller than that of the upper, lower, right, and left pusher portions.

[0034]

Since the cross-sectional diameter of the center pusher portion is different from that of the surrounding pusher portions as described above, the pushing sensation experienced when the center pusher portion is pressed is different from that experienced when one of the upper, lower, right, and left pusher portions is pressed, in the same manner as Fig. 6. Consequently, the key operation can be smoothly performed without causing an erroneous operation.

[0035]

Fig. 8(a) is a section view taken along the line A-A of Fig. 1 and showing the configuration of an assembled 5-direction key operating device of a fourth embodiment of the invention. Although the shape of pusher portions 26 is trapezoidal in the same manner as Figs. 2(a) and 3, ribs or bosses 28 stand between the pusher portions 26. As shown in Fig. 8(b), four bosses 28a are disposed between four pusher portions 26a which are placed in upper, lower, right, and left sides, or, as shown in Fig. 8(c), ribs 28b are disposed. According to this configuration, the pushing sensation experienced when the center pusher portion is pressed is made different from that experienced when one of the upper, lower, right, and left pusher portions is

pressed.

[0036]

Fig. 9(a) is a section view taken along the line A-A of Fig. 1 and showing the configuration of an assembled 5-direction key operating device of a fifth embodiment of the invention. Although the shape of pusher portions 26 is trapezoidal in the same manner as Figs. 2(a), 3, and 8(a), a skirt portion is wider in the forward, rearward, rightward, and leftward directions, and narrower in directions which are tilted by 45 degrees in an example of Fig. 9(b). By contrast, in an example of Fig. 9(c), the skirt portion is thinner in the forward, rearward, rightward, and leftward directions, and thicker in directions tilted by 45 degrees.

[0037]

In the fifth embodiment of the invention, as described above, the structure of the key skirt portion 29 disposed on a key base 27, particularly the width or thickness of the key skirt portion 29 is adjusted, so that the pushing sensation experienced when the center pusher portion is pressed is made different from that experienced when one of the upper, lower, right, and left pusher portions is pressed.

[0038]

Figs. 10(a) and 11(a) are section views taken along the line A-A of Fig. 1 and showing the configuration of an

assembled 5-direction key operating device of a sixth embodiment of the invention. Although the shape of pusher portions 26 is trapezoidal in the same manner as Figs. 2(a), 3, and 8(a), the shape of a skirt portion 29 disposed on a key base 27 is adjusted, so that the pushing sensation experienced when the center pusher portion is pressed is made different from that experienced when one of the upper, lower, right, and left pusher portions is pressed.

[0039]

Specifically, with respect to the shape of the skirt portion 29, portions where the key skirt portion has less slackening as shown in Fig. 10(b), and those where the key skirt portion has increased slackening as shown in Fig. 10(c) are placed in a different manner in the forward, rearward, rightward, and leftward directions, and in the directions tilted by 45 degrees, as in the cases of Figs. 9(b) and 9(c). According to this configuration, the pushing sensation experienced when the center pusher portion is pressed can be made different from that experienced when one of the upper, lower, right, and left pusher portions is pressed.

[0040]

With respect to the shape of the skirt portion 129, as shown in Figs. 11(b) and 11(c), shapes in which the position where the key skirt portion starts is shifted are placed in a different manner in the forward, rearward,

rightward, and leftward directions, and in the directions tilted by 45 degrees. According to this configuration, the pushing sensation experienced when the center pusher portion is pressed can be made different from that experienced when one of the upper, lower, right, and left pusher portions is pressed.

[0041]

Fig. 12 is a section view showing the diaphragm configuration of an assembled 5-direction key operating device of a seventh embodiment of the invention. The embodiment is configured so that five diaphragms 23 are proximately arranged in a shape of a cross, and a load on the center diaphragm is changed from loads on the upper, lower, right, and left diaphragms. In the case of Fig. 12, the load on the center diaphragm is set to 2.5 N, and the load on the upper, lower, right, and left diaphragms is set to 1.6 N, so that the difference is 0.9 N.

[0042]

According to this configuration, the pushing sensation experienced when the center pusher portion is pressed can be made different from that experienced when one of the upper, lower, right, and left pusher portions is pressed.

[0043]

The values to which the loads are set are determined by actually setting and then performing key

operations at the loads. The values of Fig. 12 are not fixed.

[0044]

The values of the loads of Fig. 12 are varied also in accordance with the configurations of Figs. 2(a) to 11(a). From this viewpoint, the values of loads are not fixed.

[0045]

[Effects of the Invention]

As described above, according to the invention, a 5-direction key operating device can be provided in which an operation space can be reduced, and desired one of information displayed on a display section can be selected and determined by a smooth key operation without causing an erroneous operation.

[Brief Description of Drawings]

[Fig. 1]

Fig. 1 is a view showing the configuration of a 5-direction key operating device of an embodiment of the invention.

[Fig. 2]

Fig. 2(a) is a section view taken along the line A-A of Fig. 1 and showing the configuration of an assembled 5-direction key operating device of a first embodiment of the invention, and

Fig. 2(b) is a view of a key sheet as viewed from

the below.

[Fig. 3]

Fig. 3 is a section view taken along the line A-A of Fig. 1 and showing another configuration of the assembled 5-direction key operating device of the first embodiment of the invention.

[Fig. 4]

Fig. 4 is a section view taken along the line A-A of Fig. 1 and showing the configuration of an assembled 5-direction key operating device of a second embodiment of the invention.

[Fig. 5]

Fig. 5 is a section view taken along the line A-A of Fig. 1 and showing another configuration of the assembled 5-direction key operating device of the second embodiment of the invention.

[Fig. 6]

Fig. 6 is a section view taken along the line A-A of Fig. 1 and showing the configuration of an assembled 5-direction key operating device of a third embodiment of the invention.

[Fig. 7]

Fig. 7 is a section view taken along the line A-A of Fig. 1 and showing another configuration of the assembled 5-direction key operating device of the third embodiment of the invention.

[Fig. 8].

Fig. 8(a) is a section view taken along the line A-A of Fig. 1 and showing the configuration of an assembled 5-direction key operating device of a fourth embodiment of the invention,

Fig. 8(b) is a view of a key sheet as viewed from the below in the case where bosses stand erected, and

Fig. 8(c) is a view of a key sheet as viewed from the below in the case where ribs stand.

[Fig. 9]

Fig. 9(a) is a section view taken along the line A-A of Fig. 1 and showing the configuration of an assembled 5-direction key operating device of a fifth embodiment of the invention,

Fig. 9(b) is a view showing an example of a shape in which a key skirt portion has less slackening, and

Fig. 9(c) is a view showing an example of a shape in which the key skirt portion has increased slackening.

[Fig. 10]

Fig. 10(a) is a section view taken along the line A-A of Fig. 1 and showing the configuration of an assembled 5-direction key operating device of a sixth embodiment of the invention,

Fig. 10(b) is a view showing an example in the case where a skirt portion is wider in the forward, rearward, rightward, and leftward directions, and narrower in

directions which are tilted by 45 degrees, and

Fig. 10(c) is a view showing an example in the case where the skirt portion is thinner in the forward, rearward, rightward, and leftward directions, and thicker in directions which are tilted by 45 degrees.

[Fig. 11]

Fig. 11(a) is a section view taken along the line A-A of Fig. 1 and showing another configuration of the assembled 5-direction key operating device of the sixth embodiment of the invention,

Fig. 11(b) is a view showing a first example of a shape in which a position where a key skirt portion starts is shifted, and

Fig. 11(c) is a view showing a second example of a shape in which the position where the key skirt portion starts is shifted.

[Fig. 12]

Fig. 12 is a view showing the configuration of diaphragms of a 5-direction key operating device of a seventh embodiment of the invention.

[Fig. 13]

Fig. 13 is a view showing the configuration of a conventional 5-direction key operating device.

[Description of Reference Numerals]

| | |
|----|----------------------------------|
| 10 | cover |
| 20 | 5-Direction key operating device |

| | |
|-----|-----------------------------------|
| 21 | key sheet |
| 22 | ten keys |
| 23 | diaphragm |
| 24 | printed circuit board |
| 25 | key top |
| 26 | pusher portion |
| 27 | key base (made of rubber) |
| 28 | rib/boss |
| 29 | key skirt portion |
| 100 | main unit of a portable telephone |
| 101 | display section |
| 102 | operation section |
| 103 | cursor-movement key |
| 104 | enter key |
| 105 | ten keys and other keys |

[Name of Document] Abstract

[Abstract]

[Object] The object is to provide a 5-direction key operating device in which an operation space can be reduced, and desired one of information displayed on a display section can be selected and determined by a smooth key operation without causing an erroneous operation.

[Means for Solution] Five diaphragms are shown on the printed circuit board, and five pusher portions are disposed on a key core face opposed to the diaphragms and on a key base. The height of the upper, lower, right, and left pusher portions is set to be different from that of the center pusher portion.

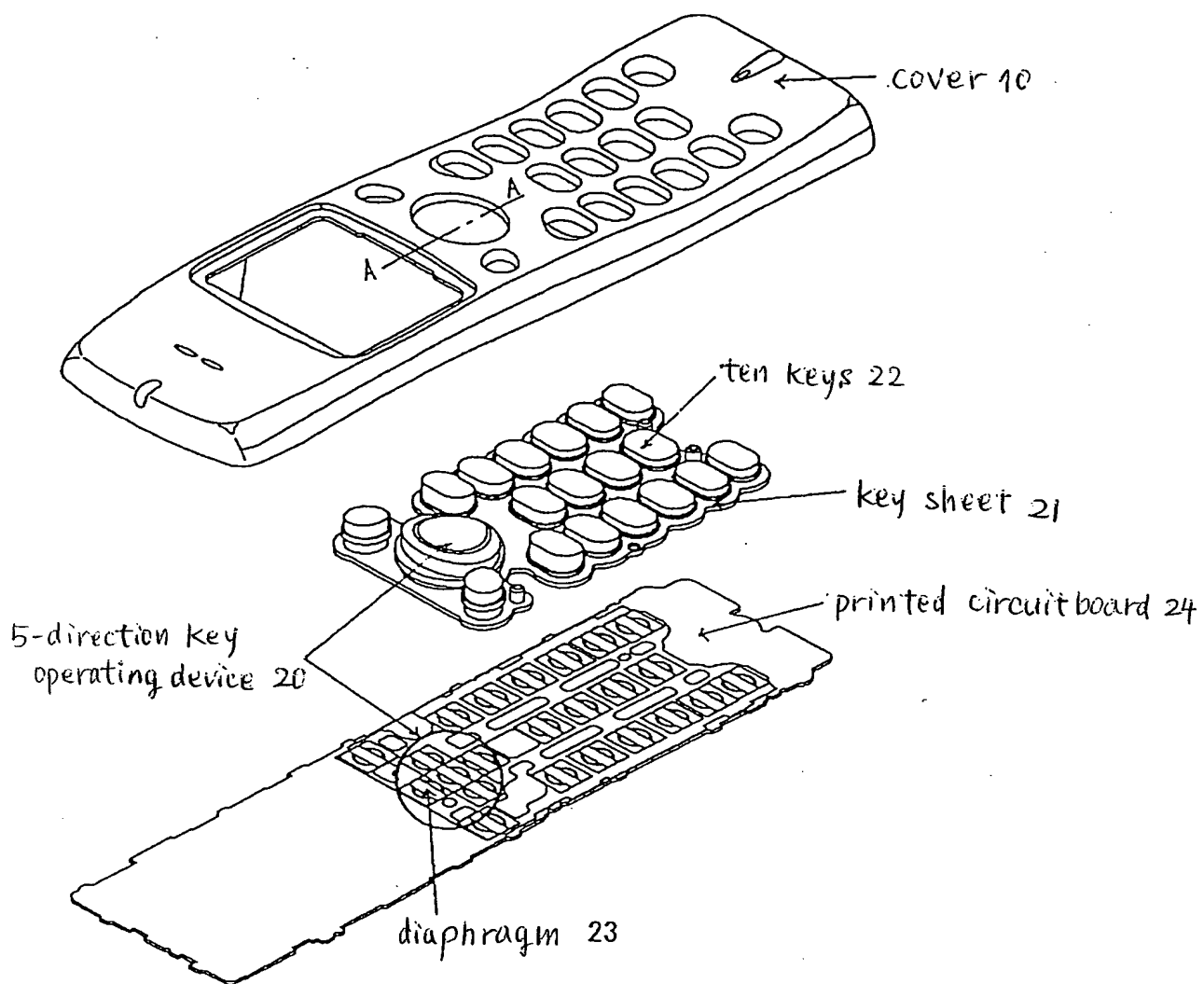
[Selected Figure] Fig. 2

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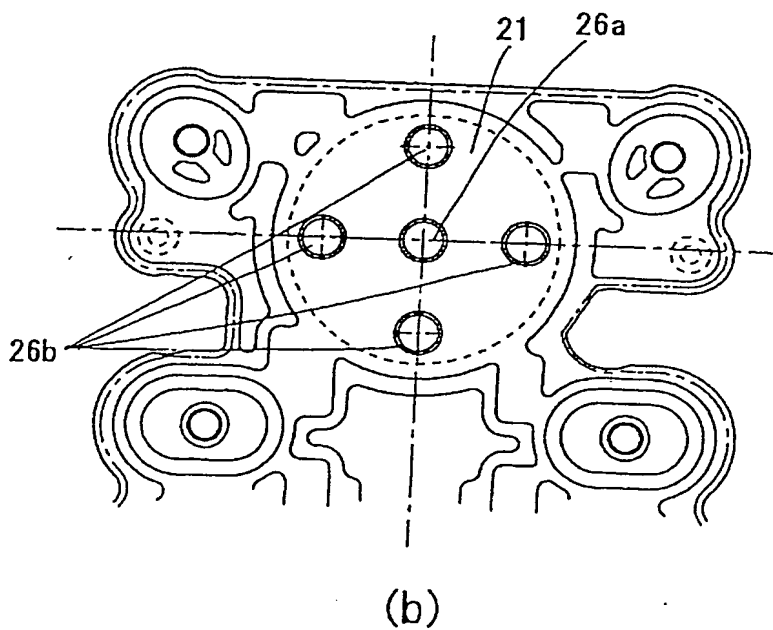
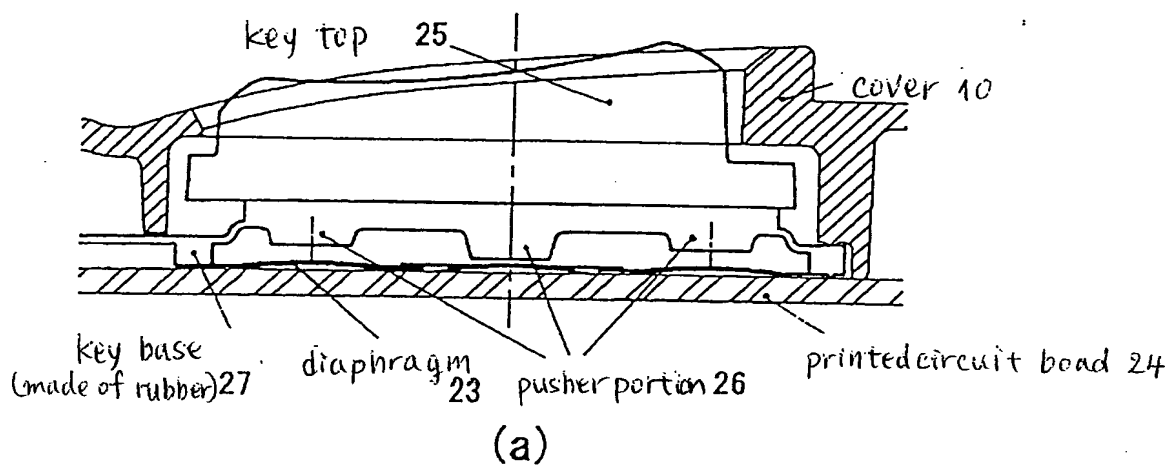
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DRAWINGS

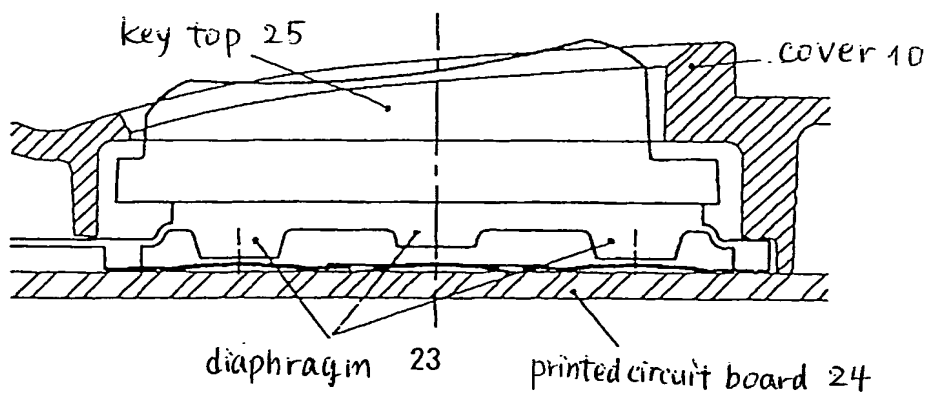
[Fig. 1]



[Figs.2]



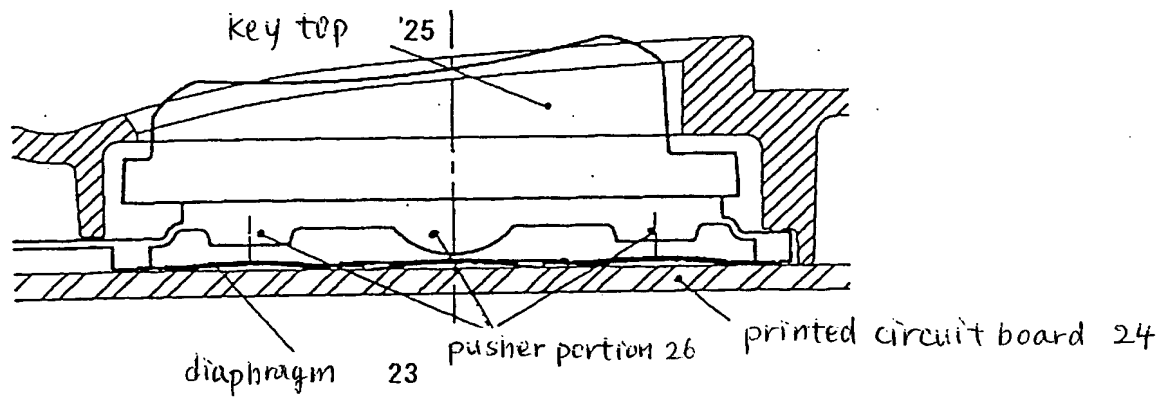
[Fig.3]



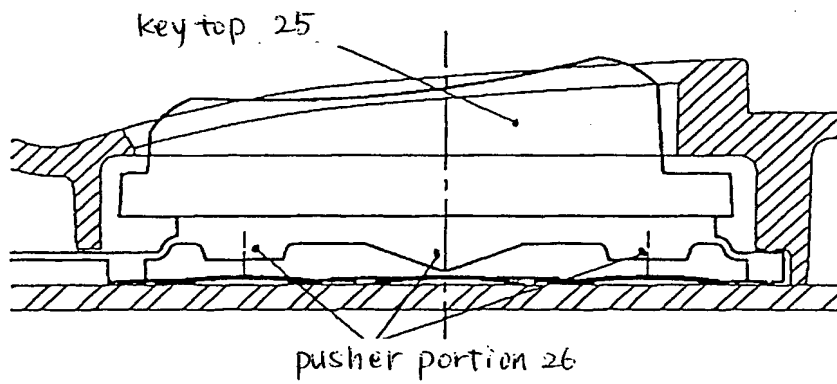
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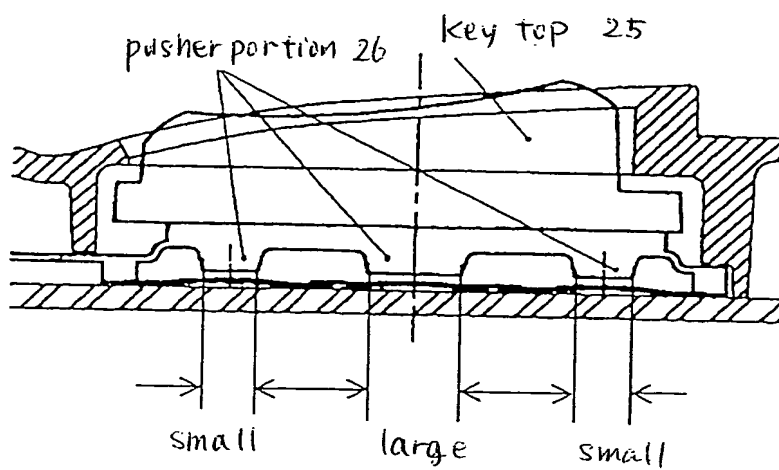
[Fig. 4]



[Fig. 5]



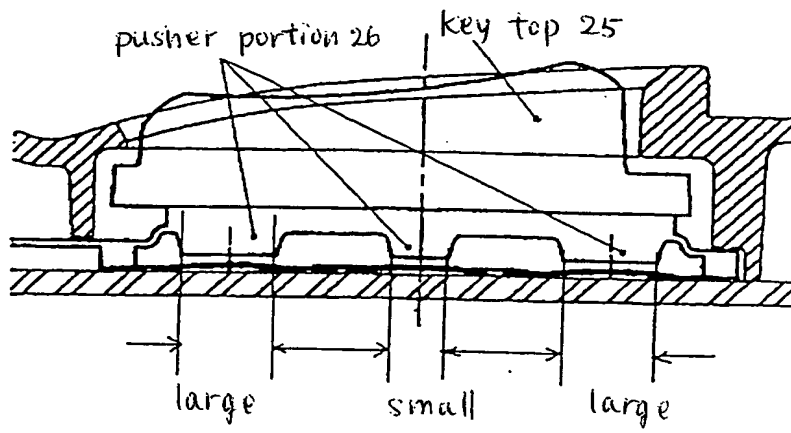
[Fig. 6]



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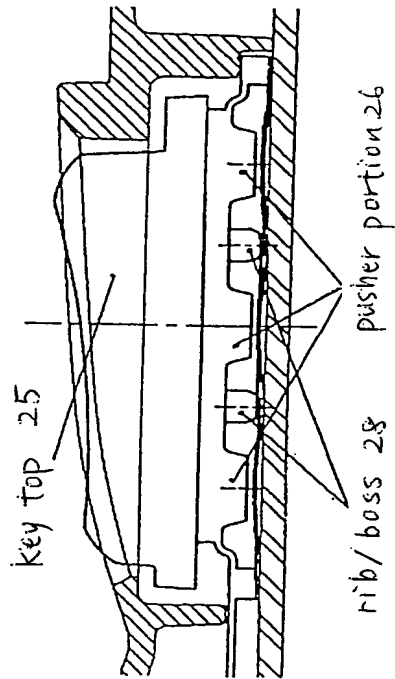
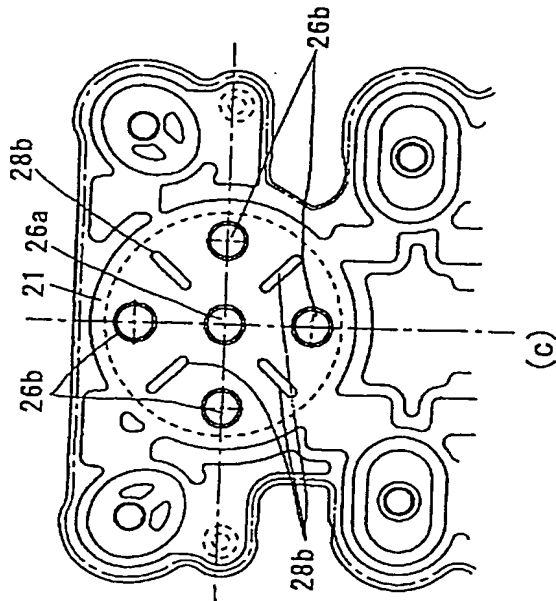
[Fig. 7]



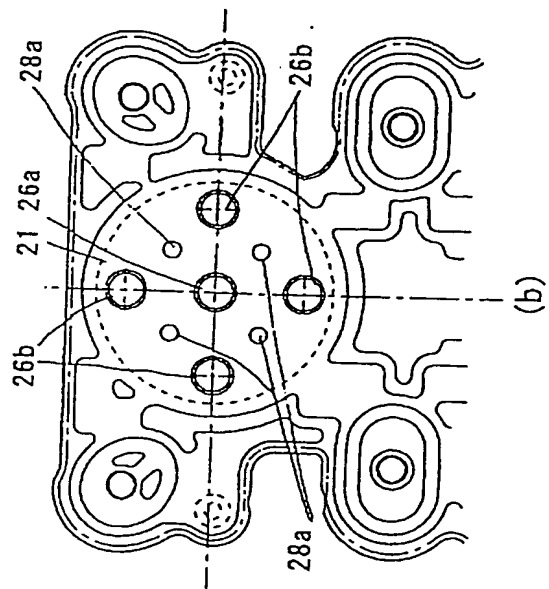
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[Figs. 8]



(a)

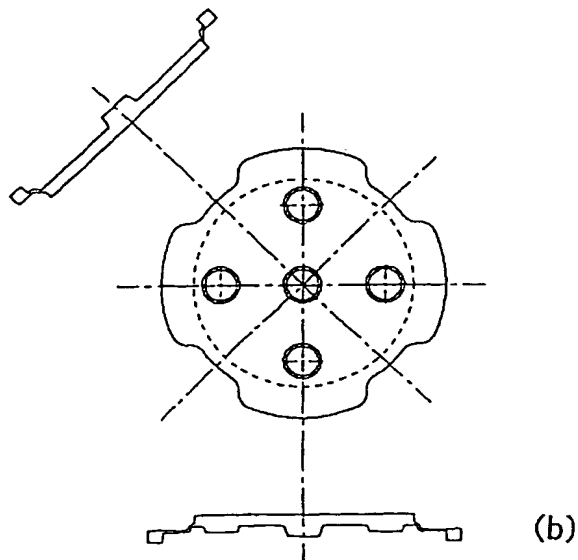
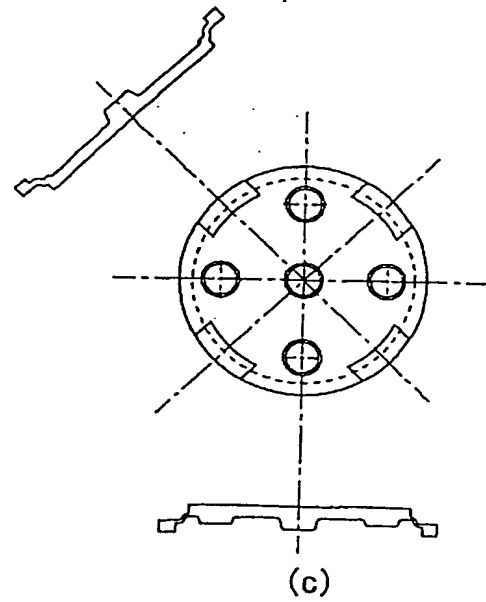
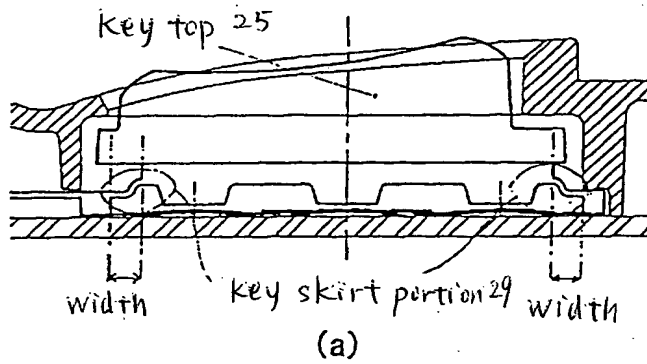


(b)

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[Figs 9]

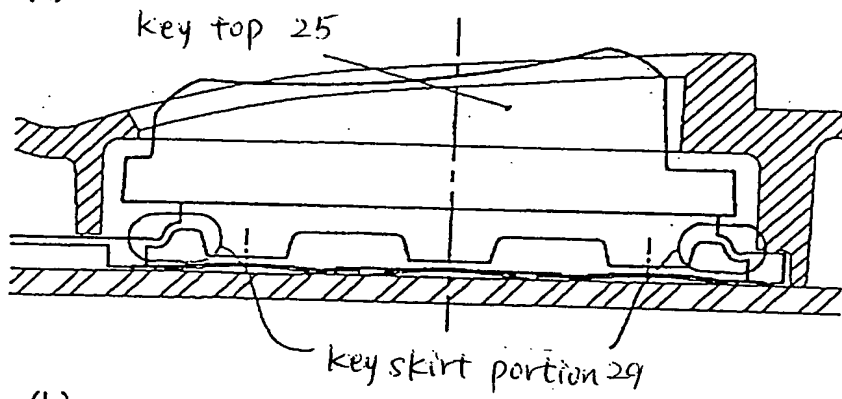


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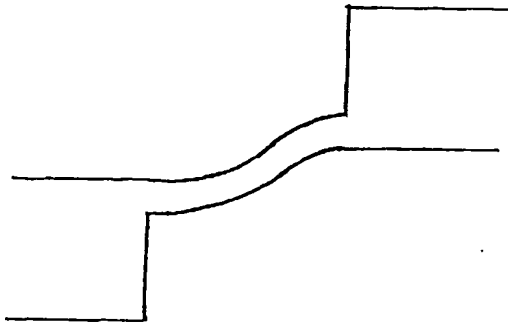
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[Figs. 10]

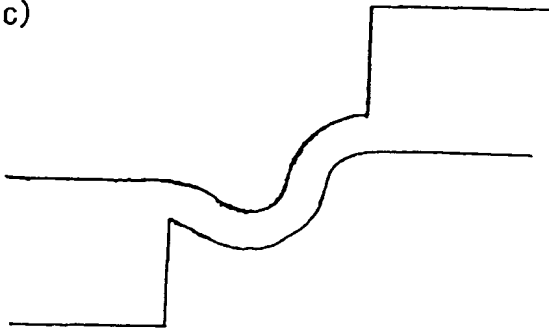
(a)



(b)



(c)

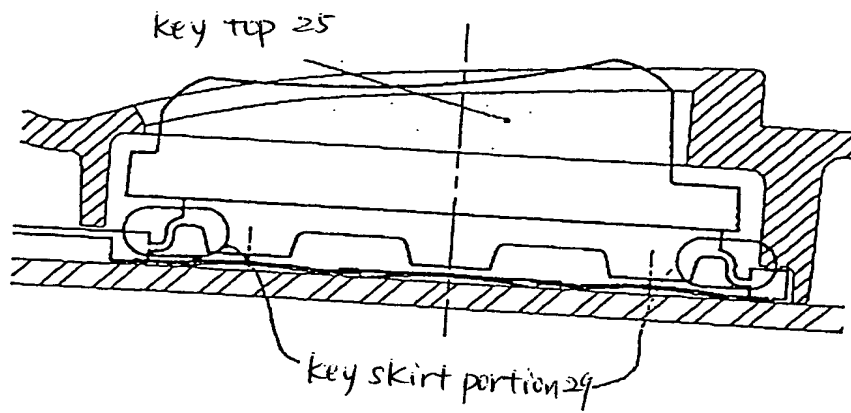


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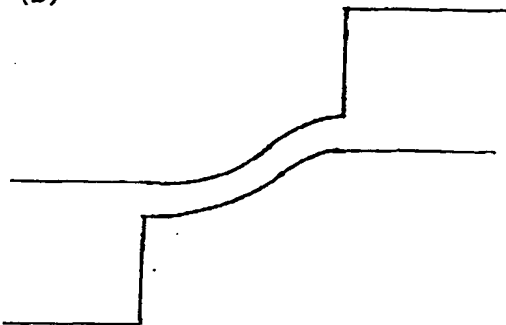
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[Figs. 11]

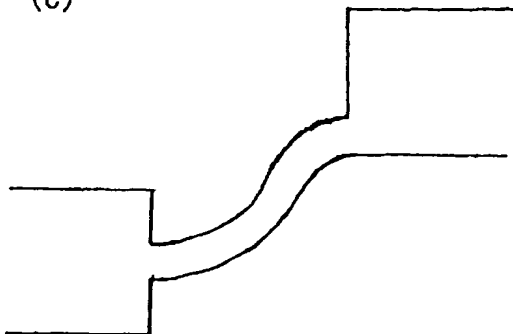
(a)



(b)



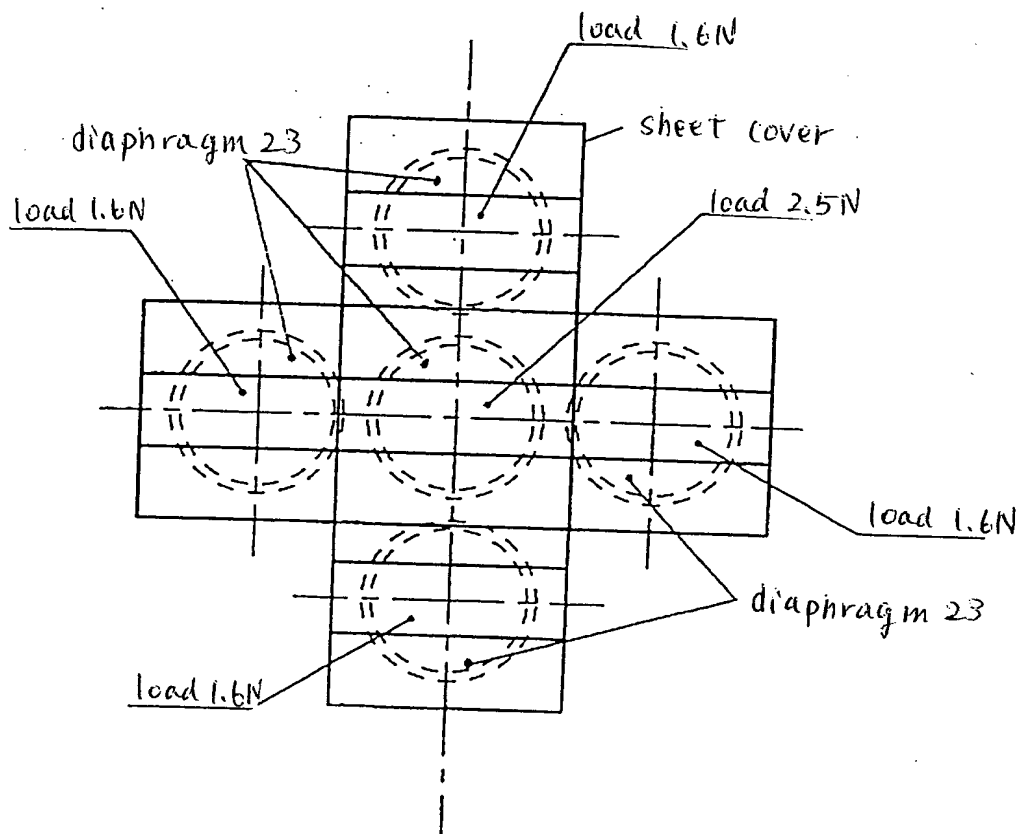
(c)



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[Fig. 12.]



Reference No. = 2904819587 Hei. 11-281741
[Fig. 13]

